IQAN-LC5-C0x
Instruction book

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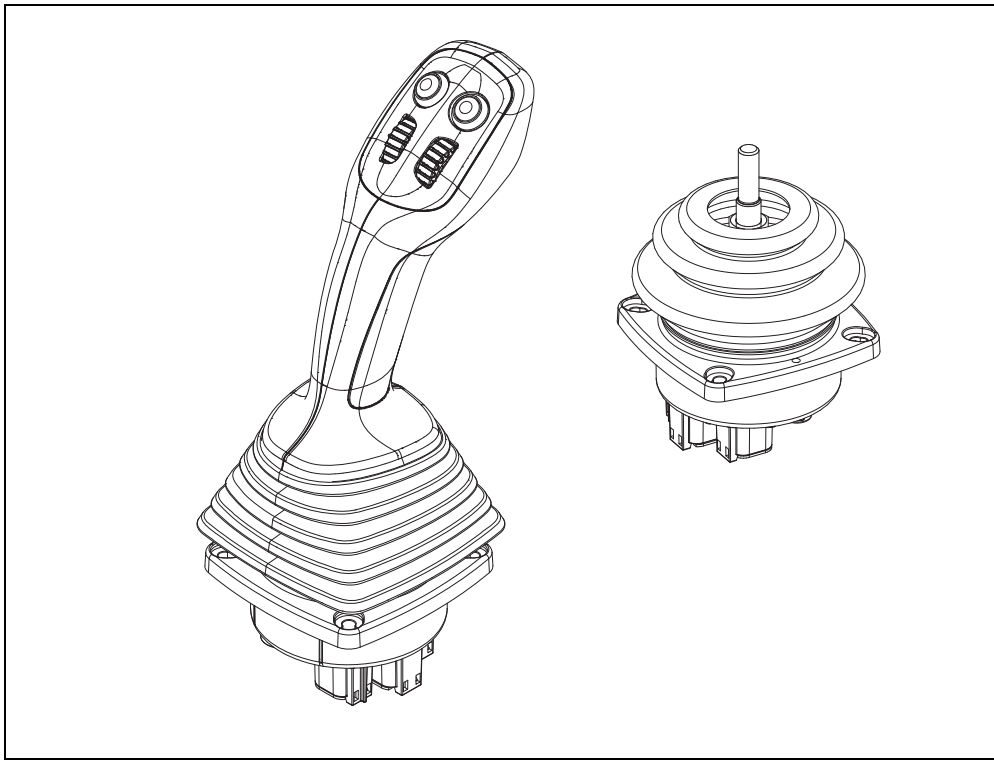

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1 Introduction

These instructions are to be used as a reference tool for the vehicle manufacturer’s design, production, and service personnel.

The user of these instructions should have basic knowledge in the handling of electronic equipment.

Warnings

Sections marked with a symbol in the left margin, must be read and understood by everyone using the system, carrying out service work, or making changes to hardware and software.

The different symbols used in this manual are defined below.

WARNING

Sections labeled *WARNING* with a caution symbol in the left margin, indicate that a hazardous situation exists. We use warnings, marked with the warning symbol, in two ways.

- As a strong recommendation about work practices when using the product in the machine (e.g. routines when updating an application). This use is common to the term 'hazardous situation', that a person is exposed to a hazard.
- As a way of pointing out important information for the machine designer that in some way relates to safety. This includes the design of the physical machine, and also the application program being developed for the control system.

Not all document sections that contain information about safety are marked with a warning symbol (there would be warnings everywhere). Failure to comply with the recommendations can cause unintentional, and unexpected behavior of the control system. This can potentially cause death, serious injury or property damage.

NOTICE

Sections labeled *NOTICE* with a notice symbol in the left margin, indicate there is important information about the product. Ignoring this could result in less than optimal performance, or damage to the product.

Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.

The term "manufacturer" refers to Parker Hannifin Corporation.

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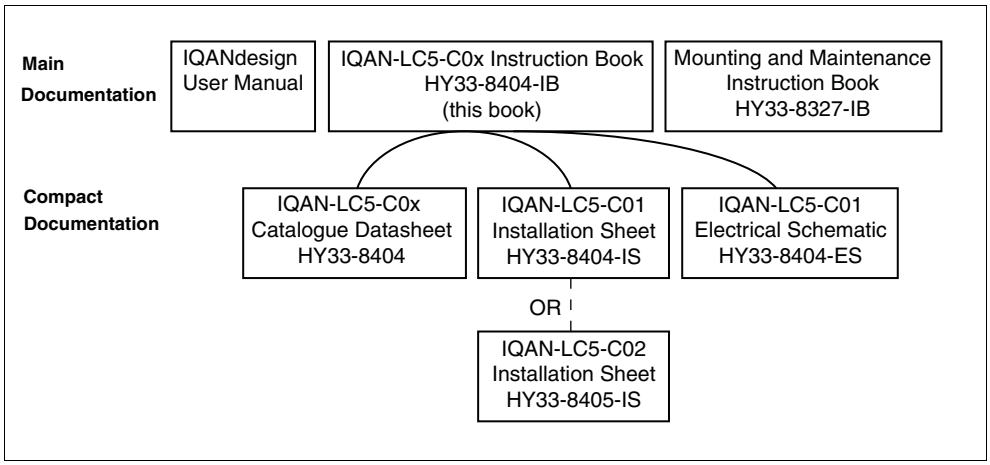
Overview of relevant documentation

The following publications are relevant for users of this product.

The main documentation contains information that is not found elsewhere.

The additional documentation contains product information in a compact format, for details on the information found in those documents, consult this manual.



The IQAN-LC5-C0x module documentation system.

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2 Precautions

General safety regulations

Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine and its safety regulations.

WARNING

Mounting, modification, repair and maintenance must be carried out in accordance with the manufacturer's regulations. The manufacturer has no responsibility for any accidents caused by incorrectly mounted or incorrectly maintained equipment. The manufacturer does not assume any responsibility for the system being incorrectly applied, or the system being programmed in a manner that jeopardizes safety.

WARNING

Damaged product may not be used. If the control system shows error functions or if electronic modules, cabling or connectors are damaged, the system shall not be used.

WARNING

Electronic control systems in an inappropriate installation and in combination with strong electromagnetic interference fields can, in extreme cases, cause an unintentional change of speed of the output function.

NOTICE

As much as possible of the welding work on the chassis should be done before the installation of the system. If welding has to be done afterwards, the electrical connections on the system must be disconnected from other equipment. The negative cable must always be disconnected from the battery before disconnecting the positive cable. The ground wire of the welder shall be positioned as close as possible to the place of the welding. The cables on the welding unit shall never be placed near the electrical wires of the control system.

Construction regulations

WARNING

The vehicle must be equipped with an emergency stop which disconnects the supply voltage to the control system's electrical units. The emergency stop must be easily accessible to the operator. The machine must be built if possible, so that the supply voltage to the control system's electrical units is disconnected when the operator leaves the operator’s station.

Safety during installation

WARNING

Incorrectly positioned or mounted cabling can be influenced by radio signals which can interfere with the functions of the system.

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Safety during start-up

WARNING

The machine's engine must not be started before the control system is mounted and its electrical functions have been verified.

Ensure that no one is in front, behind or nearby the machine when first starting up the machine.

Follow the instructions for function control in the Start-up section.

Safety during maintenance and fault diagnosis

WARNING

Ensure that the following requirements are fulfilled before any work is carried out on the hydraulics control electronics.

- The machine cannot start moving.
- Functions are positioned safely.
- The machine is turned off.
- The hydraulic system is relieved from any pressure.
- Supply voltage to the control electronics is disconnected.

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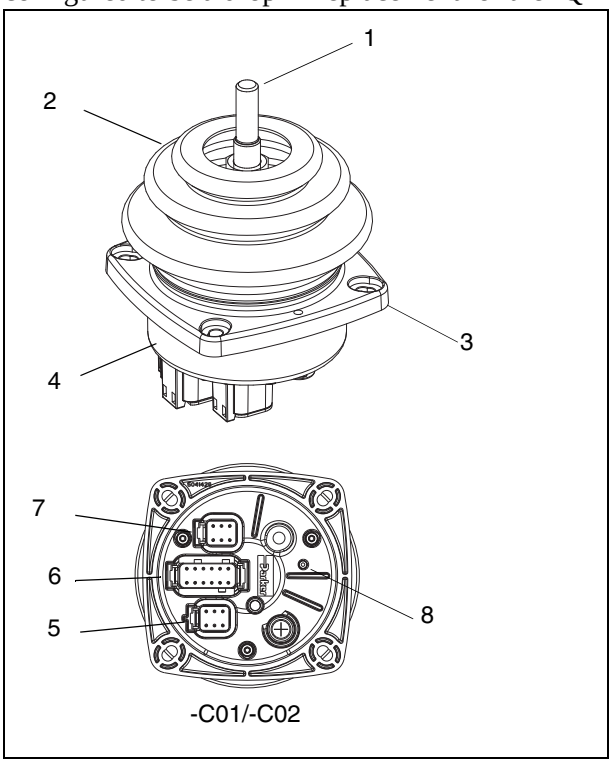
3 Product description

IQAN-LC5-C0x

The CAN joystick replaces IQAN-LL (fourth generation) coordinate levers and therefore is called IQAN-LC5 (**L**ever, **C**oordinate **5**th generation). The designation -C01 (**C**ANbus, type **01**) represents the CAN version. The joystick version -C02 is configured to be a drop-in replacement for the IQAN-LL-2U.



The IQAN-LC5-C0x parts

The control lever's parts

Control lever -LC5-C0x consists of:

1 Stem, -U2 shown, no handle mounted, (-H1 ball knob, will fit to stem).

2 Bellows, -U2 shown, no handle mounted, (other bellows for -H1 ball knob).

3 Mounting flange.

4 Lower enclosure.

5 Connector C1 for CAN bus, supply voltage, address idTag (-C01, -C02).

6 Connector C2 for inputs and outputs (-C01, -C02).

7 Connector C3 for inputs and outputs (-C01, -C02).

8 Indicator for supply voltage and status (-C01, -C02).

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The IQAN-LC5-C0x control signals

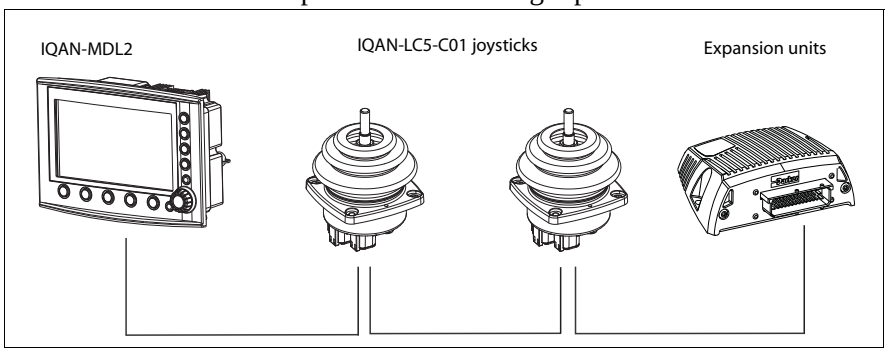
The IQAN-LC5-C0x is used to control the object in two directions:

- the lever is moved to the right/left, direction X +/-.
- the lever is moved forward/back, direction Y +/-.

The control signal is proportional to the lever's working range.

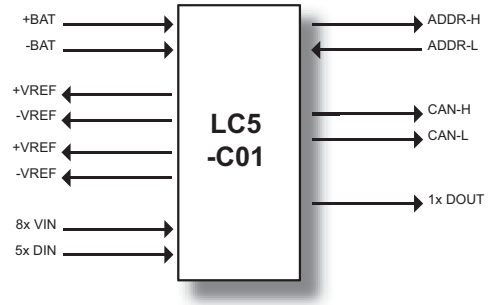
The control signal is transferred internally from the IQAN-LC5-C0x via the CAN bus to the IQAN master unit. The control signal's data is treated in the system and is then available as an output signal, for example in the expansion unit IQAN-XA2.

The IQAN-LC5-C01 has three Deutsch DTM connectors built into its base. Connector C1 is a 6 position connector for power, CAN and addressing of the joystick. Connector C2 is a 12 position connector for internal and external analog or digital signals, which may come from the handle of the joystick, or from other input devices in an armrest or panel. Connector C3 is an additional 6 position connector that will provide VREF for external sensors and accepts 4 external analog inputs.



IQAN-LC5-C01 in a typical system

I/O overview -C01



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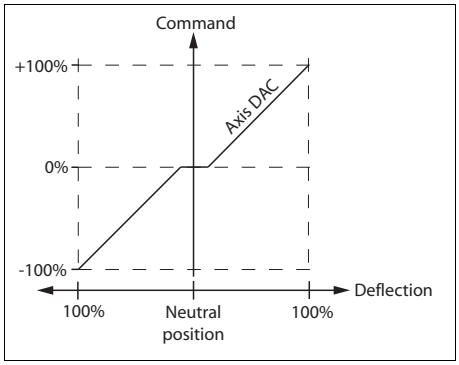
Directional Analogue Channels (DAC)

The IQAN-LC5-C01 joystick has five (5) *directional analogue channels* for use in IQAN applications. These are assigned to X-axis, Y-axis and up to three additional proportional command signals denoted as Z1 thru Z3 (when the -MP handle is used). The DAC channels are sent to the master unit via CAN and defined using IQAN software.



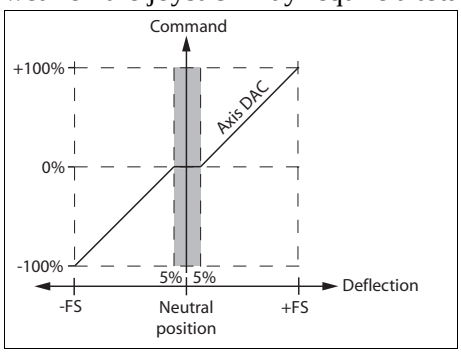
IQAN-LC5-C0x DAC channel

(2) Coordinate DAC outputs DAC-X and DAC-Y (internal, not in connectors)

(3) Auxiliary DAC outputs DAC-Z1 thru DAC-Z3 (external, via C2/C3 connectors)

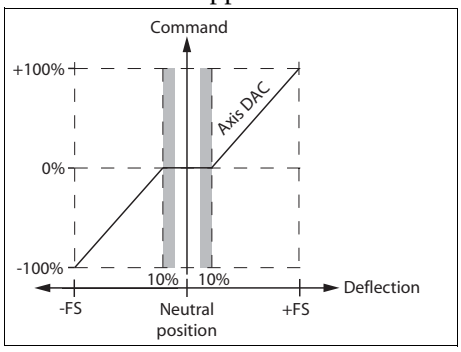
Joystick Deadband X, Y

The unit has a built in deadband of 5%. During the lifetime of the unit, the mechanical wear on the joystick may require a total deadband of 10%.



IQAN-LC5-C0x default deadband

To allow for wear over the life of the joystick, an additional 5 % should be added to the deadband in the application.



IQAN-LC5-C0x minimum recommended deadband

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Inputs

The IQAN-LC5-C01 module has eight (8) *voltage inputs* in the C2/C3 connectors for internal (-MP handle) or external signals.

(8) Voltage inputs VIN-A thru VIN-H

There are five (5) *digital inputs* in the C2 connector for external signals.

(5) Digital inputs DIN-A thru DIN-E

Outputs

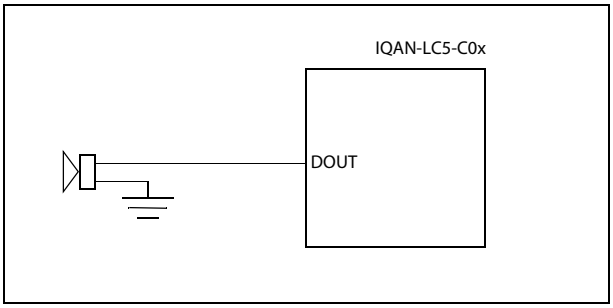
For the IQAN-LC5-C01 there is one (1) *digital output*, DOUT-A.

(1) Digital output DOUT-A

The digital ouput is intended for loads like warning lamps or audible signals.

Connection of DOUT

Connect the alarm (audio signal) between pin C2:7 and -BAT (the battery's negative pole). See the illustration below. An active output gives battery voltage (9-32 Vdc) to the pin. The maximum load is 200 mA.



Connection of DOUT as an alarm output.

IQAN-LC5-C0x CAN related functions

The master unit uses a CAN-bus (CAN = Controller Area Network) to communicate with the IQAN-LC5-C0x module. The CANbus is a robust communication protocol that is widely used and well proven within the automotive industry.

IQAN-LL replacement / IQAN-LC5-C02

For existing installations with fourth generation joystick, IQAN-LL, there is a compatible configuration based on the IQAN-LC5-C01. The IQAN-LC5-C02 has three connectors built into its base. Connector C1 with 6 positions is for power, CAN and addressing of the joystick. Connector C2 with 12 positions is used to connect the IQAN-LL external I/O to the IQAN-LC5-C02. Connector C3 is an additional 6 position connector that is used for the possible existing IQAN-LL handle functions. An adapter harness is available to make retrofitting simpler for the end-user.

NOTICE

Use IQAN-LC5-C01 for new applications.

The IQAN-LC5-C02 is meant for service part usage in existing IQAN-LL installations. An adapter cable allows drop-in replacement for service parts. The IQAN-LC5-C01 should be specified for all new machine production.

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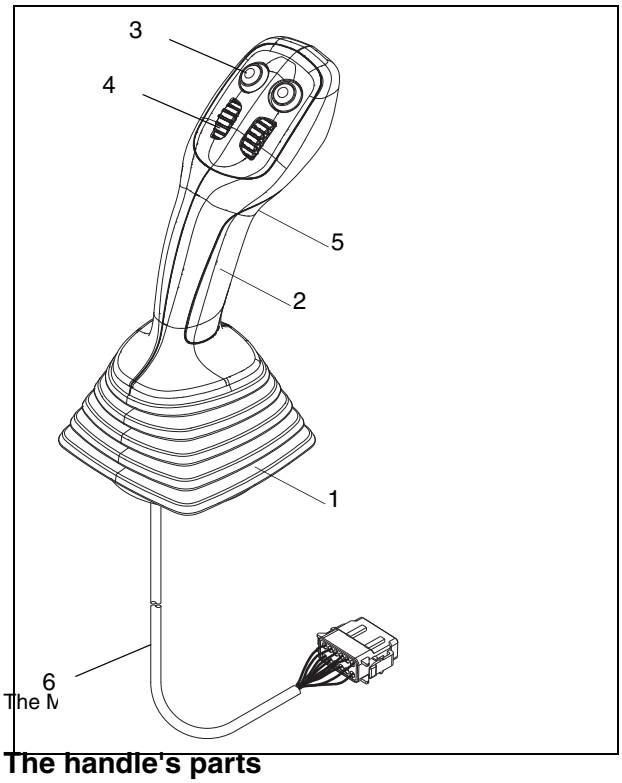
MP handle

The IQAN-LC5-C01 is designed to be used with the Multi-Purpose (MP) handle. The MP handle together with a IQAN-LC5-C01 base will have one Deutsch DTM connector for interfacing to connector C2 or C3 in the joystick base.

In order to reduce operator fatigue, the MP handle incorporates a hand rest, and is designed for both left and right-handed use.

To extend operating life the housing is made of a corrosive-free material, and is specially adapted for moisture drainage to protect the the system electronics. The MP handle uses a bellow that can be quickly changed to simplify field replacement. The cable between base and handle is routed directly through the base plate, eliminating the risk of damage and simplifying field service, while the use of a single circuit board and Hall effect sensors minimise the number of components and moving parts.



The M

The handle's parts

MP handle consists of:

1 Bellows, -MP handle.

2 Handle, -MPB2W2T1 shown, (other configurations are possible).

3 Momentary buttons.

4 Proportional thumbwheel (-MP handle thumbwheel has dual, mirrored outputs).

5 Momentary trigger button.

6 Cable and connector for -MP (6 pos. or 12 pos., depending on handle functions connected to the base).

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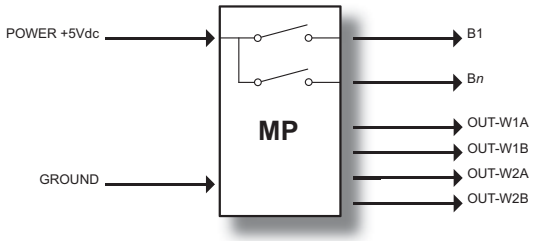
I/O overview, MP handle



Buttons and thumbwheels

Digital

The MP handle has up to nine (9) buttons that are connected as *digital inputs* on the IQAN-LC5-C01 base.

(8) momentary buttons B1 thru B8

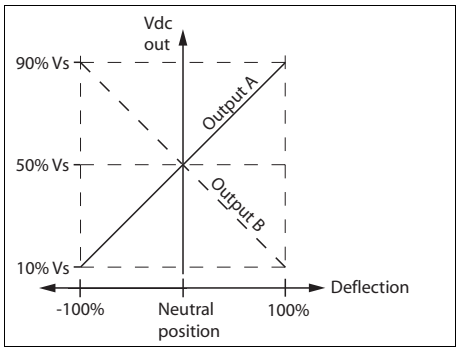
(1) momentary trigger button T1

Analogue

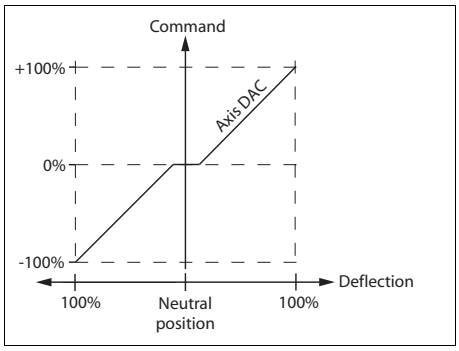
The MP handle has up to two (2) thumbwheels that are connected as *analogue intputs* in the IQAN-LC5-C01 base. The thumbwheels have dual outputs that may be connected to voltage inputs, but are best used for auxiliary DAC channels Z1-Z2.

(2) Primary analogue outputs OUT-W1A and OUT-W2A, 10%-90% Vs

(2) Secondary analogue outputs OUT-W1B and OUT-W2B, 90% - 10% Vs



MP handle outputs per thumbwheel used as dual analogue inputs.



MP handle thumbwheel used as auxiliary DAC.

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4 Safety

Redundant signals

In order to fulfill high safety demands, the joystick IQAN-LC5-C0x uses dual mirrored sensors per axis. The sensor signals are compared in the controller; both have to show matching activation for that axis to activate, and they have to match over the whole joystick stroke. If a fault is detected the DAC channel will not be activated.

Internal diagnostics

The module performs a number of self-checks that improve safety. Checks include monitoring of voltage supplies, checksums on memory and a watchdog that monitors software execution. The module uses a real time operating system, which supervises software execution.

If a critical error is detected, the module is stopped, with CAN bus and outputs off.

CAN-bus interruption

The IQAN-LC5-C0x communicates with an IQAN master module on the CAN bus. Both the master and the IQAN-LC5-C0x check for any interruptions in the CAN-bus communication. If an error occurs the master will use zero, or an application defined error value for the joystick inputs, and its outputs will be off.

The error will be indicated both on the master module and with a blink code on the unit, see Appendix B, on page 32.

Deadband

To prevent activation in the neutral position, the IQAN-LC5-C0x has a small built in deadband, see section Joystick Deadband X, Y, on page 7. It may be necessary to set an additional deadband in the application to increase the margin of safety.

Magnetic Fields

WARNING

Risk of injury! Do not use in areas with high magnetic fields.

The IQAN-LC5 is based on hall effect sensors. Exposure to high external magnetic fields may lead to unwanted activation of the output signals.

For maximum allowed external magnetic field, see Appendix A, on page 28.

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5 Mounting

Mounting the unit

NOTICE

The IQAN-LC5-C0x unit should be mounted according to the following instructions.

Mounting considerations

- The control lever must be built in so that it is protected against direct pressurized liquid spray (above flange) and excessive mechanical forces.
- The machine manufacturer must consider the need of a protective catch, or similar, to prevent unintentional working of the lever.

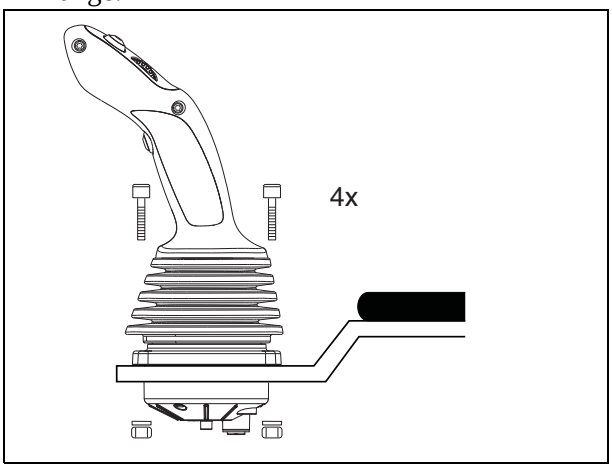
NOTICE

Take careful consideration when positioning the unit.

- Mount the unit so that it is not exposed to external heat, e.g. from the engine or heater.
- Mount the unit so there is no risk that the harness can be folded, crushed, worn or damaged in any way.
- Locate the harness so there is no pressure on the connector.
- Use ergonomics. The control lever should be mounted at a height so that there is no pressure on the driver's arm and shoulders. The IQAN-LC5-C0x and a well designed handle, such as the MP, combined with moveable arm rests, can provide good ergonomics. Always consider ergonomics when installing hand controls.

Mounting methods

- Control lever IQAN-LC5-C0x must only be mounted using screws through the flange.



Mounting the IQAN-LC5-C01 with screws.

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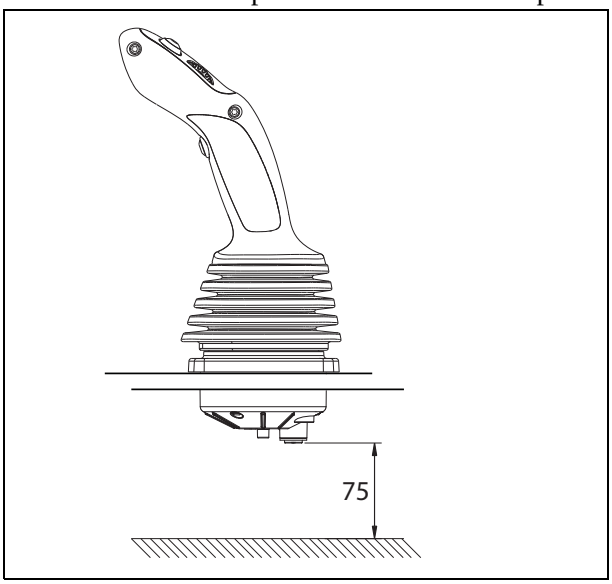
- Allow sufficient space beneath the unit to provide for unplugging the connectors.



Required space for connectors.

For mounting dimensions, see Appendix C, on page 34.

Handle considerations

Recommended handle specification

In addition to the MP handle, the IQAN-LC5-C01 will accept OEM specified handles. These handles will need to be adapted to mount on the joystick stem. The maximum weight of any handle fitted to the IQAN-LC5-C01 combined with its center of gravity (COG), shall not cause more force than the minimum activation moment. For the minimum activation force, see Appendix A, on page 28. Any tilting of the lever by armrest movement or possible machine leveling or orientation should be taken into consideration when specifying a suitable handle.

WARNING

Risk of injury! Exceeding the recommended handle specifications could cause unintended movement of the joystick.

Environmental specification

Any handle used with the IQAN-LC5-C01 should be a sealed type that is rated IP65 for outdoor use. Additionally, the joystick must always have a bellow installed to ensure that it will meet the environmental specification for sealing above the flange. When using a handle from a different manufacturer than Parker, be sure to include a suitable bellow made of a material that is able to withstand the stresses of outdoor use in mobile hydraulic machinery.

NOTICE

Failure to use a properly fitted bellow of the correct material will cause the unit to not meet its environmental specification and may result in damage to the IQAN-LC5-C01 joystick.

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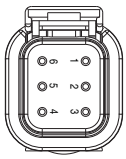
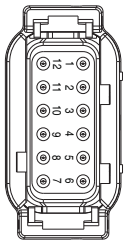
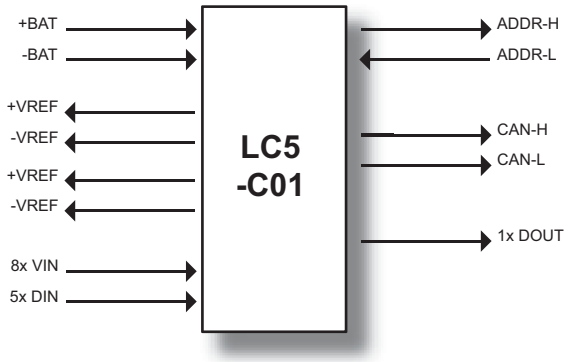
6 Installation

IQAN-LC5-C0x connectors

Connector kit	**Parker 5035007**	
Housing,C1/C3	Deutsch no. DTM06-6S	**C1/C3**
Pin type	Deutsch no. 1062-20-0222	
Wedge type	Deutsch no. WM6S	
Sealing plug	Deutsch no. 0413-204-2005	
Housing, C2	Deutsch no. DTM06-12SA	**C2**
Pin type	Deutsch no. 1062-20-0222	
Lock type	Deutsch no. WM12S	
Sealing plug	Deutsch no. 0413-204-2005	
Recommended cable	0.75-1 mm^2 (18 AWG)	







Connector C1 pin assignments (-C01 & -C02)

Symbol	**Pin No.**	**Function**
+BAT	6	Power supply
-BAT	1	Power supply
CAN-L	2	CAN low voltage bus line.
CAN-H	5	CAN high voltage bus line.
ADDR-L	3	Address
ADDR-H	4	Address

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Connector C2 pin assignments (-C01)

Symbol	Pin No.	Function
+VREF-A	12	Voltage reference for external sensors. Sourcing +5V.
-VREF-A	1	Voltage reference for external sensors. Return (0V).
VIN-A DIN-F DAC-Z1P	2	Input from -MP handle or external device
VIN-B DIN-G DAC-Z1S	3	Input from -MP handle or external device
VIN-C DIN-H DAC-Z2P	10	Input from -MP handle or external device
VIN-D DIN-I DAC-Z2S	11	Input from -MP handle or external device
DIN-A	4	Input from -MP handle or external device
DIN-B	5	Input from -MP handle or external device
DIN-C	6	Input from -MP handle or external device
DIN-D	8	Input from -MP handle or external device
DIN-E	9	Input from -MP handle or external device
DOUT-A	7	Output

Connector C3 pin assignments (-C01)

Symbol	Pin No.	Function
+VREF-B	6	Voltage reference for external sensors. Sourcing +5V.
-VREF-B	1	Voltage reference for external sensors. Return (0V).
VIN-E DIN-J DAC-Z3P	2	Input from -MP handle or external device
VIN-F DIN-K DAC-Z3S	3	Input from -MP handle or external device
VIN-G DIN-L	4	Input from -MP handle or external device
VIN-H DIN-M	5	Input from -MP handle or external device

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Connector C2 pin assignments (-C02)

Symbol IQANdesign	**Symbol** IQANdevelop	**Pin No.**	**Function**
+VREF-A	+VREF-A	12	Voltage reference for external sensors. Sourcing +5V.
-VREF-A	-VREF-A	1	Voltage reference for external sensors. Return (0V).
VIN-A DIN-G	VIN-A	2	Input from external device
VIN-B DIN-H	VIN-B	3	Input from external device
DIN-A	DIN-A	4	Input from external device
DIN-B	DIN-B	5	Input from external device
DIN-C	DIN-C	6	Input from external device
DIN-D	DIN-D	8	Input from external device
DIN-E	DIN-E	9	Input from external device
DIN-F	DIN-F	10	Input from external device
DOUT-A	DOUT-A	7	Output
Not used	Not used	11	No connection

Connector C3 pin assignments (-C02)

Symbol IQANdesign	**Symbol** IQANdevelop	**Pin No.**	**Function**
+VREF-B	+VREF-B	6	Voltage reference for external sensors. Sourcing +5V.
-VREF-B	-VREF-B	1	Voltage reference for external sensors. Return (0V).
DIN-I	DIN-G	2	Input from handle
DIN-J	DIN-H	3	Input from handle
DIN-K	DIN-I	4	Input from handle
DIN-L	DIN-J	5	Input from handle

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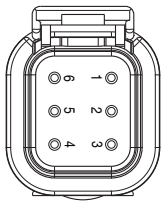
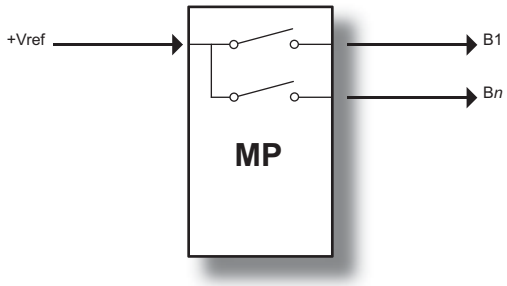
MP handle connector, 6 position for C3 connection

Connector parts	**Parker 20072408**
Housing	Deutsch no. DTM06-6S
Pin type	Deutsch no. 1062-20-0222
Wedge type	Deutsch no. WM6S
Sealing plug	Deutsch no. 0413-204-2005
Supplied on handle types	MPB0W0T1, MPB2W0T0, MPB2W0T1, MPB4W0T0

C3





Connector, 6 position assignments

	MPB0W0T1	**MPB2W0T0**	**MPB2W0T1**	**MPB4W0T0**
Symbol	**Pin No.**	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-B	6	6	6	6
B1		2	2	2
B2		3	3	3
B3				4
B4				5
T1	4		4	

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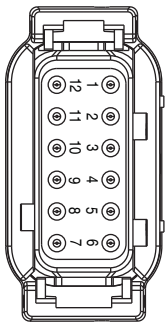
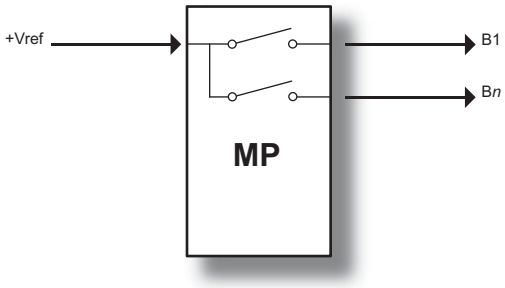
MP handle connector, 12 position for C2 connection

Connector parts	**Parker 20072406**
Housing	Deutsch no. DTM06-12SA
Pin type	Deutsch no. 1062-20-0222
Wedge type	Deutsch no. WM12S
Sealing plug	Deutsch no. 0413-204-2005
Supplied on handle types	MPB4W0T1, MPB8W0T0, MPB8W0T1, MPB2W2T0, MPB2W2T1, MPB4W1T0, MPB4W1T1

C2





Connector, 12 position assignments

	MPB4W0T1	**MPB8W0T0**	**MPB8W0T1**
Symbol	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-A	12	12	12
B1	4	4	4
B2	5	5	5
B3	6	6	6
B4	8	8	8
B5		2	2
B6		3	3
B7		10	10
B8		11	11
T1	9		9

Types with thumbwheels continued in separate table.

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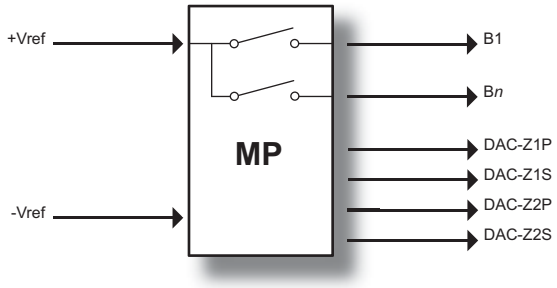

Connector, 12 position assignments

	MPB2W2T0	MPB2W2T1	MPB4W1T0	MPB4W1T1
Symbol	**Pin No.**	**Pin No.**	**Pin No.**	**Pin No.**
+Vref-A	12	12	12	12
-Vref-A	1	1	1	1
B1	4	4	4	4
B2	5	5	5	5
B3			6	6
B4			8	8
T1		9		9
DAC-Z1S	3	3	3	3
DAC-Z1P	2	2	2	2
DAC-Z2P	10	10		
DAC-Z2S	11	11		

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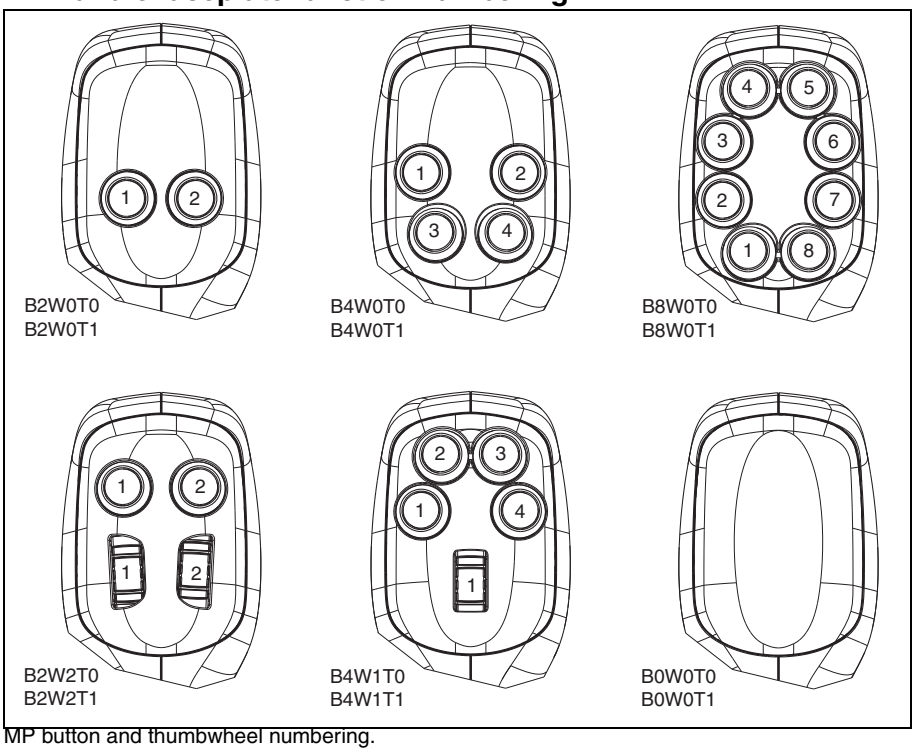
Required connectors, based on model code

Model code	5035007 kit with housings for C1/C2/C3	20072408 kit with 6 pin housing for C1	20072406 kit with 12 pin housing for C2
IQAN-LC5-C01-U1	1 pc		
IQAN-LC5-C01-U2	1 pc		
IQAN-LC5-C01-H1	1 pc		
IQAN-LC5-C01-MPB0W0T0	1 pc		
C3 connector from MP handle cable is factory mounted in joystick base			
IQAN-LC5-C01-MPB0W0T1		1 pc	1 pc
IQAN-LC5-C01-MPB2W0T0		1 pc	1 pc
IQAN-LC5-C01-MPB2W0T1		1 pc	1 pc
IQAN-LC5-C01-MPB4W0T0		1 pc	1 pc
C2 connector from MP handle cable is factory mounted in joystick base			
IQAN-LC5-C01-MPB4W0T1		2 pcs	
IQAN-LC5-C01-MPB8W0T0		2 pcs	
IQAN-LC5-C01-MPB8W0T1		2 pcs	
IQAN-LC5-C01-MPB4W1T0		2 pcs	
IQAN-LC5-C01-MPB4W1T1		2 pcs	
IQAN-LC5-C01-MPB2W2T0		2 pcs	
IQAN-LC5-C01-MPB2W2T1		2 pcs	

MP handle faceplate function numbering



MP button and thumbwheel numbering.

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IQAN-LC5-C01 supply voltage

WARNING

Before any installation of the IQAN system can take place, make sure the ignition lock is turned off and the battery is disconnected.

Emergency stop

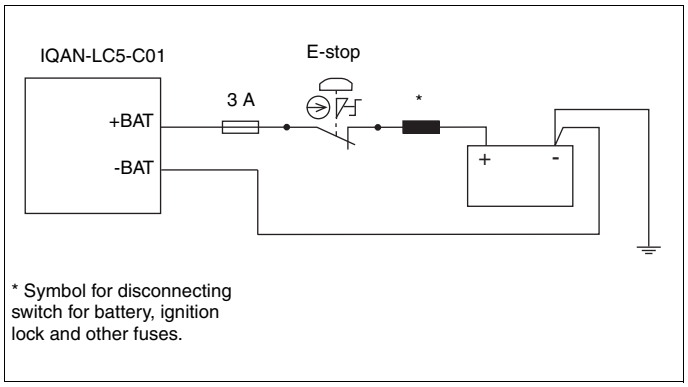
Make sure an *Emergency Stop* disconnecting the power supply, is easily accessible at any time. The figure below shows how to connect the emergency stop.

Connecting of supply voltage, -C0x

The supply voltage, should be within the operating range, see Appendix A, on page 28.

Connect the supply voltage to +BAT pin C1:6. The ground connection is made from -BAT pin C1:1 to the negative terminal of the battery..

EXAMPLE



Connecting an IQAN-LC5-C0x to power supply.

NOTICE

Do not use the chassis as the negative terminal.

Polarity reversal

The IQAN-LC5-C0x module is protected against power supply polarity reversal. An external fuse, max 3A (Fast) must be used. Polarity reversal **can damage the unit** if the fuse is not used.

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IQAN-LC5-C0x addressing/terminating

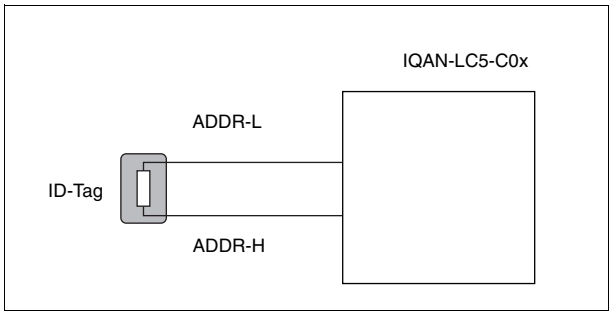
Addressing

Each IQAN-LC5-C0x module will have a specific address, enabling the *master module* to communicate with the modules through the CAN-bus. When operating, the system distinguishes between different modules by first verifying the module type and secondly, through the modules having unique addresses.

EXAMPLE

If having an IQAN-LC5-C01 module with address 0, the system will denote this one as LC5-A0, The letter "A" in the example refers to CAN-bus A.

The maximum number of similar modules in a system is four or eight depending on the master module, denoted in the first case as addresses 0, 1, 2, 3 respectively. In order to assign any IQAN-LC5-C0x module a unique CAN-address, an *ID-Tag* will have to be connected to the positions ADDR-H and ADDR-L.



Connecting of Id-Tag in IQAN-LC5-C0x connector C1.

Terminating

To eliminate interference in the communication, through the CAN-bus, the CAN-bus must be terminated. If an IQAN-LC5-C0x is located at the end of the CAN-bus then use an ID-tag having a combined address and terminating function. This is denoted with a "T" for terminating, after the appropriate address such as; 0T, 1T, 2T...

Selecting appropriate Id-Tag

- Check the address number of the module.
- If the module is located at the end of the CAN-bus then select the appropriate *ID-Tag* denoted with a "T".

NOTICE

The CAN-bus does not need to be terminated using an external 120 ohm terminating resistor, due to the fact that terminating can be made inside the IQAN-LC5-C0x module in conjunction with an installed *ID-Tag* with terminating function.

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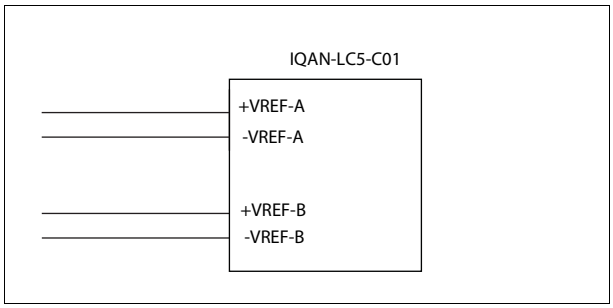
Reference voltage, VREF

The IQAN-LC5-C0x module is internally equipped with a voltage regulator to generate the reference voltage *VREF*. The standard reference voltage will feed different kinds of sensors, potentiometers and joysticks.



VREF positions in connectors C2 and C3.

NOTICE

Maximum load for the *VREF*, see Appendix A, on page 28.

Do not use the -VREF as ground for any devices that are not powered from +VREF. You could damage the unit.

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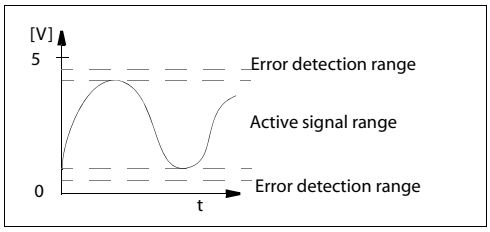
Connecting sensors and switches to IQAN-LC5-C01

Connecting sensors to the voltage inputs

The sensor signal range must be 0-5 Vdc. To detect signal errors such as short circuits or interruptions the active signal range is recommended to be within 0.5-4.5 Vdc.



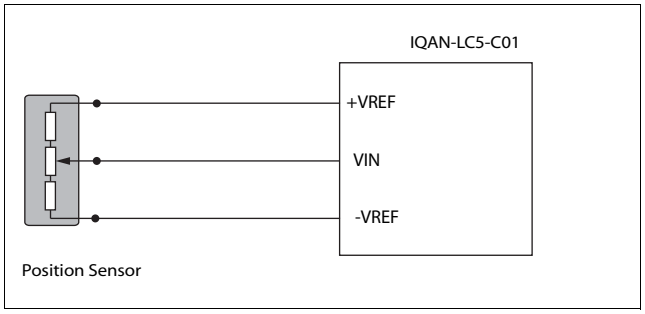
Active signal range.

The current consumption related to the voltage input is negligible.

The following describes the connection of any analog sensor. This includes temperature, pressure, angle and position sensors. The positive terminal of the sensor is connected to the +VREF position and the corresponding negative terminal to the -VREF position. The sensor signal is connected to appropriate VIN position. For a resistive type element, select the potentiometer value for the sensor to achieve the best linearity.

EXAMPLE

Connect the positive and negative terminals of the position sensor to +VREF, position C2:12, and -VREF, position C2:1, respectively. Then connect the sensor signal to VIN-A, position C2:2.



Connecting VREF and sensor signal VIN.

NOTICE

The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position, see Appendix A, on page 28.

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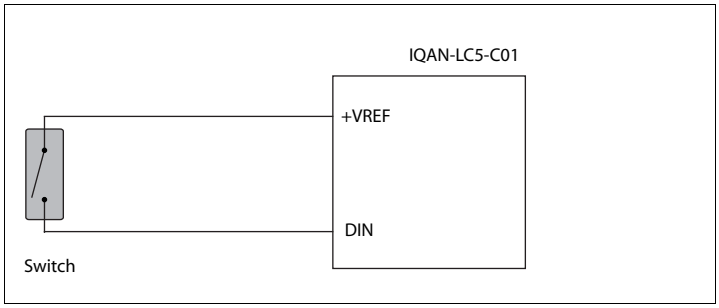
Connecting switches to the inputs

Switches could be connected to the inputs, to create a digital on/off signal. The switches may be connected to +VREF and DIN respectively for 5Vdc signal. The current consumption for the input is negligible.

EXAMPLE

Connect the positive and negative terminals of the switch to +VREF, position C2:6, and DIN-A, position C2:4, respectively.



Connecting a switch to DIN and VREF.

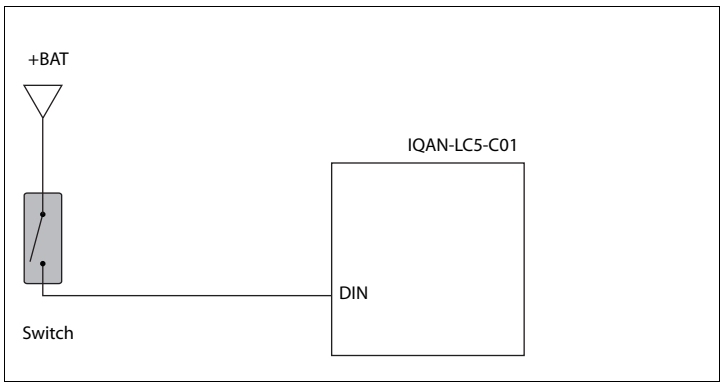
NOTICE

Maximum load for VREF position, see Appendix A, on page 28.

It is possible to connect system voltage +BAT to the input through a switch in order to reserve 5Vdc VREF for sensors and potentiometers.

EXAMPLE

Connect the positive and negative terminals of the switch to +BAT supply and DIN-A, position C2:4, respectively.



Connecting a switch to DIN and +BAT.

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7 Start-up

Start-up procedures

This chapter contains instructions for action to be taken in connection with the initial start.

WARNING
Risk of injury!
If the control system is not fitted properly, the machine could move uncontrollably. The machine's engine shall not be started before the control system is completely fitted and its signals are verified.

Starting the control system

Start the control system as follows:

- Prior to start, all modules and cables are to be fitted correctly.
- Check fuses, i.e. make sure that the supply voltage to the modules is equipped with the correct fuse.
- Make sure that connections for supply voltage and return lines are correct in the cable's conductor joint.
- Make sure an emergency stop is installed.
  The emergency stop should disconnect the supply voltage to all modules. Alternatively, the emergency stop may also shut off the diesel engine or a dump valve, and with that, depressurize the hydraulic system.

Prepare for system start

WARNING
Make sure no one is in dangerous proximity to the vehicle to avoid injuries when it starts.

Prepare for the initial system start as follows:

- The engine for the hydraulic system's pump shall be in off position.
- Make sure that all connectors are properly connected.
- Turn on the control system.
- Make sure that voltage is being supplied to all modules; the power/status diode shall be illuminated on all modules. Also, make sure that the master is in contact with all modules by reading the master's display.
- Make sure the emergency stop is functioning properly.

Start the system

Start the system as follows:

- Start the engine for the hydraulic system's pump, assuming that the above mentioned inspections have been carried out and shown correct values.
- Calibrate and adjust input and output signals according to the instructions related to the master menu system and check each and every output function carefully.

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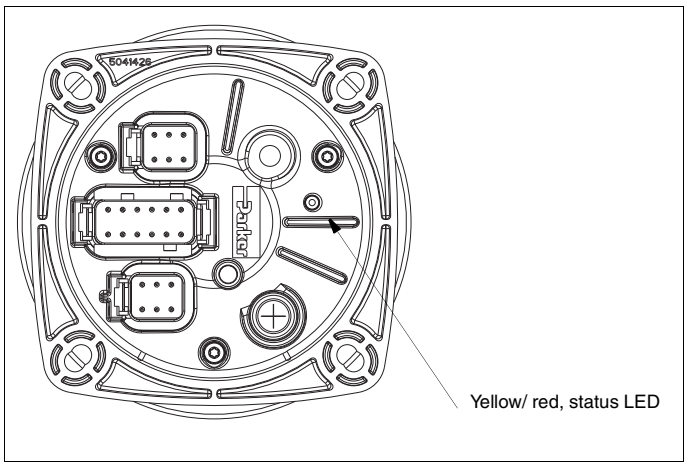
8 System Diagnostics

The yellow blinking LED on the module indicates normal status. If there is an error detected, the master will present a message on the display. The IQAN-LC5-C0x module also indicates *error status* through the red blinking LED as shown below. This gives an immediate diagnosis as to the nature of the error that has occurred.



The location of the LED indicators on the IQAN-LC5-C0x module.

The yellow/red LED will be blinking yellow once per every two seconds (0.5 hz) to indicate power and normal operating status. The LED will blink red when an error has been detected. To get futher information about the error messages, see Appendix B, on page 32.

A SMALL RECOMMENDATION...

You can use the internal diagnostics in the master to get more information about the IQAN-LC5-C0x module.

The following values are supervised:.

Internal temperature [°C]
Reference voltage [V]
CAN address voltage [V]

Note: In the IQAN-LL, the power supply (+BAT) was also monitored. For compatibility, in the IQAN-LC5-C02, the power supply is a constant, faked value.

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Appendix A

IQAN-LC5-C0x Technical Overview

IQAN-LC5-C01, base and -MP handle

Absolute Maximum Ratings[a]

Parameter	Remark
Ambient temperature, T_A	-40 to 85 °C
Storage temperature	-40 to 100 °C
Maximum voltage supply on +BAT	6 to 36 V, no system reset, power drivers will saturate at low voltage
Voltage on any pin with respect to -BAT	36 V
External magnetic fields	2.5 mT

a.The “Absolute Maximum Ratings” table lists the maximum limits to which the device can be subjected without damage. **This doesn´t imply that the device will function at these extreme conditions,** only that, when these conditions are removed and the device operated within the “Recommended Operating Conditions”, it will still be functional and its useful life won’t have been shortened.

Environmental ratings

Parameter	Remark
EMC	
Radiated emission	ISO 13766:2006/ISO 14982:1998
Conducted emission	EN 55025:2003, 0.15-108 MHz Class 2
Conducted susceptability	ISO 11452-4:2005, 1 - 200 MHz, 1 kHz, 80% AM, 100 mA
Radiated susceptability	ISO 11452-2:2004, 200-2000 MHz, 1kHz, 80% AM, 100 V/m
Conducted transients susceptability	ISO 7637-2:2004, Pulse 1, 2a, 2b, 3a, 3b, 4, 5, Level 3 ISO 7637-3:2007, Level 3
ESD	
Operation	ISO 10605:2008, 8 kV contact, 25 kV air
Handling	ISO 10605:2008, 4 kV contact
Mechanical environment	
Random vibration	IEC 60068-2-64:2008 Fh, 15 - 1000 Hz, 11.6 Grms, 3 x 10 hours
Shock	IEC 60068-2-27:2008 Ea, 40 g, 6 ms, 1000 * 6 directions
Climate environment	
Enclosure, water and dust protection	IEC 600529:2001, IP65 (with sealed handle and bellow)
Salt mist	IEC 68-2-52:1996 Kb, 72 hours (not tested)
Damp heat, cyclic	IEC 60068-2-30:2005 Db, +55°C, 95% RH, 6 cycles
Damp heat, steady state	IEC 60068-2-78:2001 Cab, +40°C, 93% RH, 21 days
Heat, operation	IEC 60068-2-2:2007 Bb, 85°C, 72 hours
Heat, storage	IEC 60068-2-2:2007 Bb, 100°C, 72 hours
Cold	IEC 60068-2-1:1993 Ab, -40°C, 16 hours
Change of temperature	IEC 60068-2-14:1984 Nb, -30°C to +85°C, 100x4 hours

System

T_A = +25 °C (unless otherwise specified)

Parameter	Remark
Weight	
Base	380 g
Base with -MP handle	750 g
Ambient temperature	-40 to 85 °C

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System

T_A = +25 °C (unless otherwise specified)

Parameter	Remark
Voltage supply, V_{BAT}	9 to 32 V
Current supply V_{BAT} =14 V V_{BAT} = 28 V	 typ. 45 mA typ. 30 mA
CAN	
CAN specification	CAN 2.0A, CAN 2.0B
CAN speed	125 to 500 kbits
Protection	SCB, SCG

VREF sensor supply

Parameter	Remark
Output voltage	5 V ±150 mV, -40 to 85 °C
Output voltage temperature drift	0.25 mV/°C, -40 to 85 °C
Maximum load current	50 mA for each VREF
Protection	overload, SCB, SCG
Diagnostics	under/over voltage, overload
Under/over voltage threshold	±150 mV from nominal value

I/O

T_A = +25 °C (unless otherwise specified)

Parameter	Remark
Base, DAC (X-Y coordinates)	
Angle of movement	±18°
Center position output	0%
Minimum position output	-100%
Maximum position output	100%
Neutral zone	10% of full deflection
Deflection moment, neutral	0.6 Nm
Deflection moment, fully activated	1.4 Nm
One time loading	100 Nm
Expected life	5 x 10^6 cycles (One cycle: Center pos. to full +direction and back, center pos. to full -direction and back)
Diagnostics	diff. check on dual antivalent signals
Base, VIN (Voltage input)	
Full scale	5000 mV ±100 mV
Resolution	10 bits (4.88 mV)
Input impedance	36 Kohm in parallel with 10 nF

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I/O

T_A = +25 °C (unless otherwise specified)

Parameter	Remark
Accuracy *with external sensor supply* *with VREF sensor supply*	 ±(0.8 % + 5 mV), -40 to 70 °C ±(0.2 % + 5 mV), -40 to 70 °C
Maximum continuous voltage	32 V
Protection	SCB, SCG
Diagnostics	defined in application
Base, DIN (on/off input)	
Input signal low	<1 V
Input signal high	>4 V
Input hysteresis	>0.55 V
Input impedance	6.2 kohm in parallel with 10 nF
Maximum continuous voltage	32 V
Diagnostics	defined in application
Base, DOUT (on/off output)	
Load current	200 mA
Power driver voltage drop	<0.70 V
Leakage current in off-state	<100 uA
Protection	overload, SCB, SCG
Diagnostics	none

IQAN-LC5-C01, -MP handle only

Thumbwheel

I/O

T_A = +25 °C, unless otherwise specified

Parameter	Remark
Handle, DAC (Z coordinates)	
Angle of movement	±25°
Center position output	0%
Minimum position output	-100%
Maximum position output	100%
Neutral zone	10% of full deflection
Current supply	max. 23 mA, typ. 16 mA (per thumbwheel)
Deflection moment, neutral	10 Nmm
Deflection moment, fully activated	15 Nmm
Expected life	5 x 10^6 cycles (One cycle: Center pos. to full +direction and back, center pos. to full -direction and back)
Diagnostics	diff. check on dual antivalent signals

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Buttons

Parameter	Remark
Expected life	$1.5x10^6$ (tested $1.5x10^6$ cycles)
Total travel	1.5 mm
Switching point	1.2 mm
Operating force	2 to 5 N
Max current	400 mA @ 32 VAC, resistive load (from mfg's documentation)
Max current	100 mA @ 50 VDC, resistive load (from mfg's documentation)

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Appendix B

Error codes, messages and actions

If one of the following errors are detected, a message will be presented on the master display together with an error code on the module. In some cases, the module will turn off, to increase safety.

WARNING

Do not use the machine if an error message or error code is activated.

The following sections will present the possible error codes and what measures to take for different error situations put into appropriate context.

LED indicator showing different IQAN-LC5-C0x modes

Status	Blink (yellow light)
Normal (no errors)	

Status	Blink (red light)
Safe state (red)	

Error code	Error	Primary Blink (red) Error category	Secondary Blink (yellow) Error description
1:1	VREF error		
3:1	CAN error		
3:2	ADDR error		
4:1	Internal error		

VREF ERROR

Situation	Error code	Action LC5-C01	Comment
VREF < 4,75 V	Error 1:1	-	Check voltage
VREF > 5,25 V	Error 1:1	-	Check voltage

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MODULE IS OFFLINE

Situation	Error code	Action LC5-C01	Comment
CAN-bus off	Error 3:1	All outputs shuts off.	Check CAN-bus
ADDR-H < 4,75 V	Error 3:2	-	Check voltage ADDR-H
ADDR-H > 5,25 V	Error 3:2	-	Check voltage ADDR-H
ADDR-L < 0,5 V	Error 3:2	During start up: The module turns off.	Check voltage ADDR-L
ADDR-L > 4,5 V	Error 3:2	During start up: The module turns off.	Check voltage ADDR-L
Internal error	Error 4:1	The module turns off.	Contact supplier.

HIGH TEMPERATURE

Situation	Error code	Action LC5-C01	Comment
Internal temperature > max temp	Error 4:1	-	Check ambient temperature

DAC ERROR

Situation	Error code	Action LC5-C01	Comment
X error, Y error	Error 4:1	Error value.	Contact supplier

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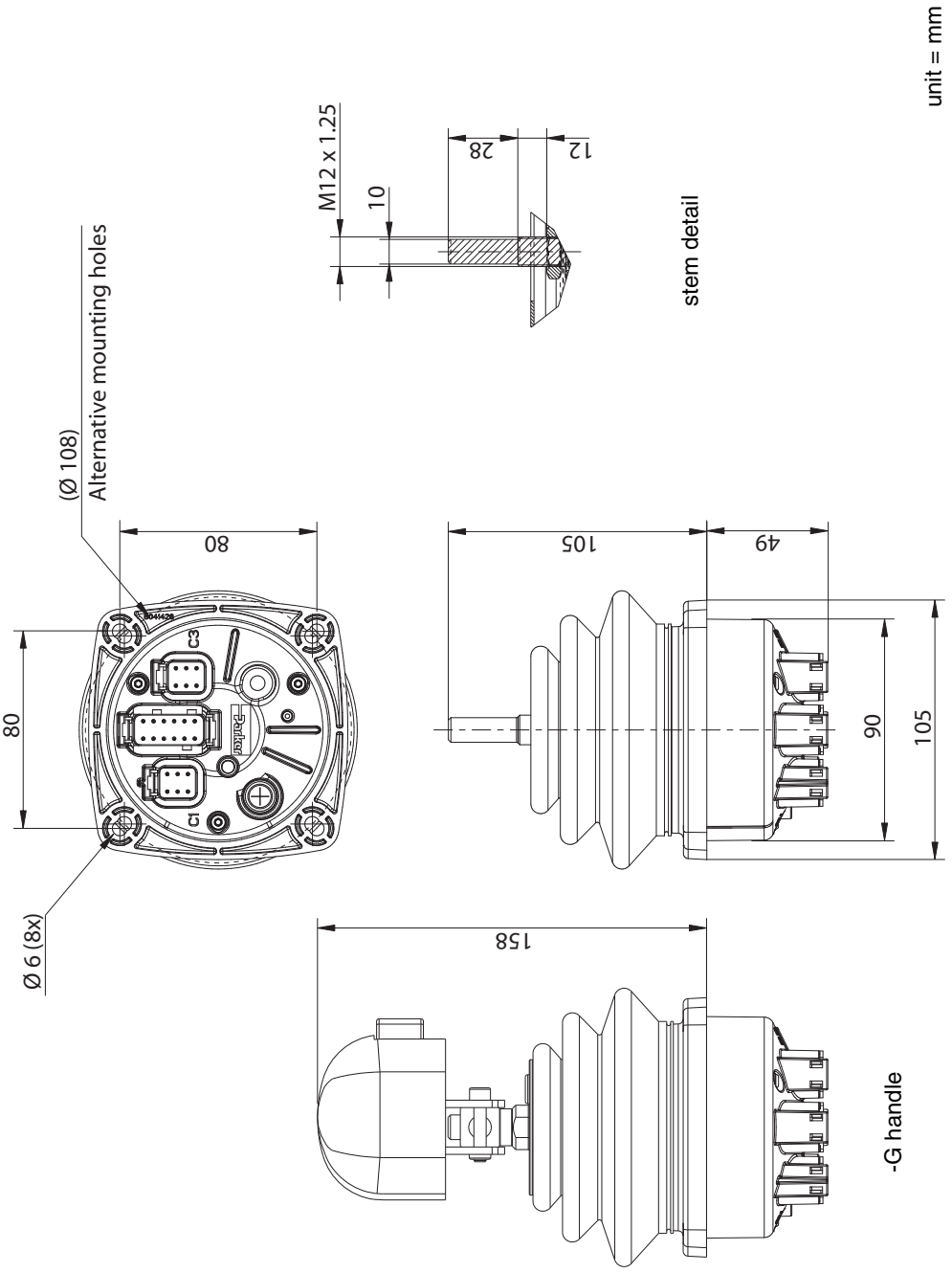
Appendix C

Dimensioning of the IQAN-LC5-C0x



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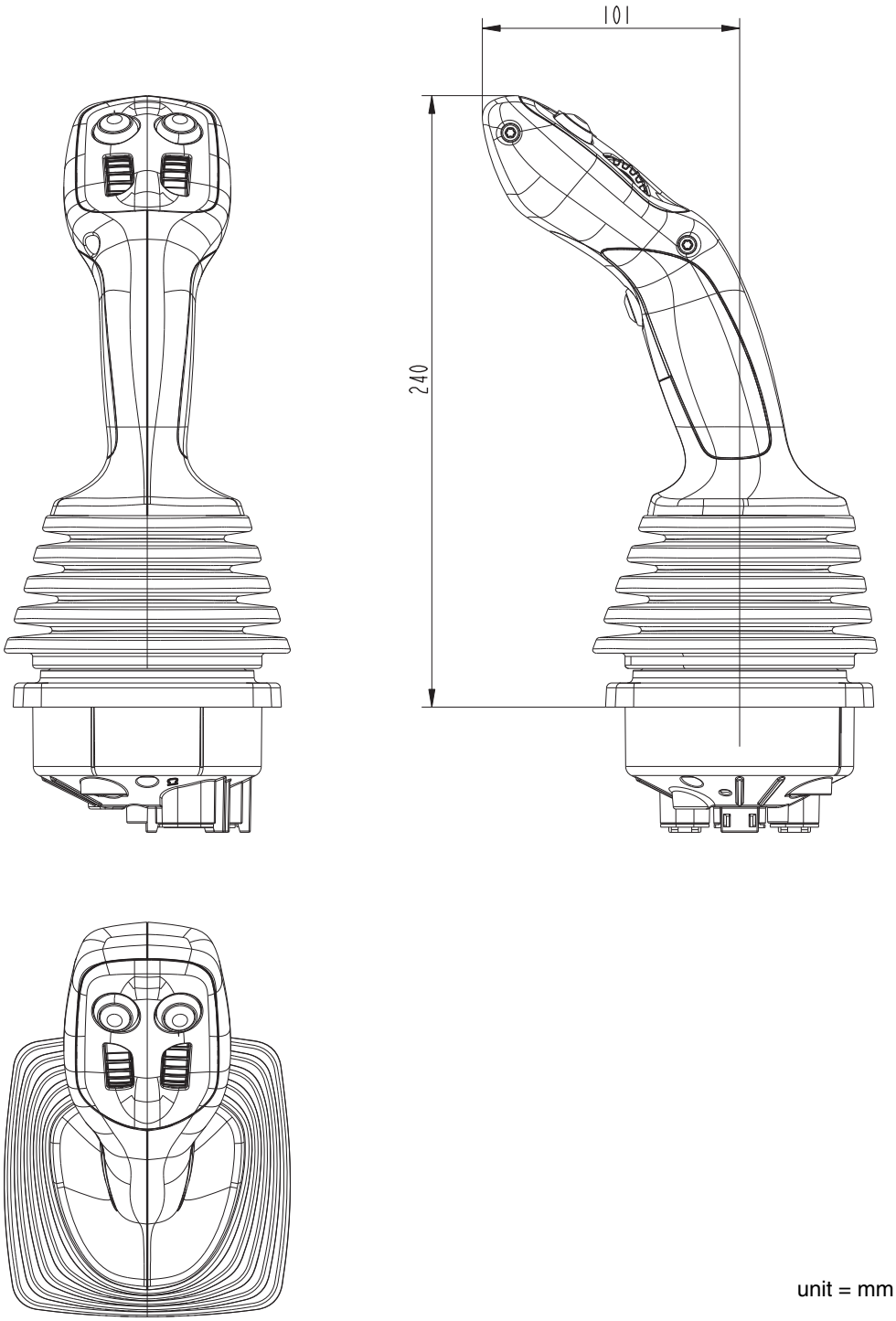
Dimensioning of the IQAN-LC5 with MP handle



unit = mm

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